

REMARKS

By this Amendment, Claims 11, 17, 18, 27-29, 38 and 41 are amended.
Claims 11, 14-19, 24-35 and 37-48 are pending in the application. Reconsideration of the Official Action is respectfully requested.

Personal Interview

Applicants thank Examiner Kackar for the courtesies extended to Applicants' undersigned representative during the personal interview conducted on July 6, 2004. The substance of the interview is incorporated in the following remarks.

Rejection Under 35 U.S.C. §112, ¶1

Claims 40 and 46 stand rejected under 35 U.S.C. §112, ¶1. The reasons for the rejection are stated on page 2 of the Official Action. The rejection is respectfully traversed.

The Official Action asserts that "the intermediate layer is claimed under the ceramic layer while the specification says the intermediate layer is above the cerium oxide containing ceramic coating." Applicants respectfully disagree.

Claims 40 and 46 recite, *inter alia*, the features of "a first intermediate layer, the ceramic layer being (i) on the first intermediate layer or (ii) on an optional second intermediate layer disposed on the first intermediate layer." As explained at paragraph [0044] of the present specification, "one or more intermediate layers of material can be provided between the cerium oxide containing ceramic coating and the surface of the component" (emphasis added). That is, in exemplary embodiments, the ceramic layer can be provided on the first intermediate layer. In

other exemplary embodiments, the ceramic layer can be provided on the second intermediate layer, which in turn is provided on the first intermediate layer. Thus, in such embodiments the ceramic layer is over the first intermediate layer or the optional second intermediate layer and not, *vice versa*, as asserted in the Office Action.

Accordingly, the specification provides a written description of the subject matter recited in Claims 40 and 46. Therefore, withdrawal of the rejection under 35 U.S.C. §112, ¶1, is respectfully requested.

First Rejection Under 35 U.S.C. §103

Claims 11, 14-19, 24-35, 37, 39, 40, 43, 45 and 46 stand rejected under 35 U.S.C. §103(a) over JP 10004083 to Itou ("Itou") in view of U.S. Patent No. 5,362,335 to Rungta ("Rungta") and U.S. Patent No. 5,721,057 to Bamberg et al. ("Bamberg"). The reasons for the rejection are stated on pages 2-3 of the Official Action. The rejection is respectfully traversed.

The Official Action asserts that Itou discloses a cerium oxide coating on the inside of a plasma chamber, clamp ring or shield ring. The Official Action further asserts that Itou "also teaches that the part could be a film or a compound (Abstract)" (emphasis added). The Official Action admits that Itou does not disclose that "the parts" have a cerium oxide layer disposed over aluminum. It is further asserted in the Official Action that Itou teaches the parts could be made of an oxide of ceramic.

The Official Action asserts that "Rungta discloses [a] corrosion-resistant barrier coating of one or more types of cerium oxide on aluminum alloy and teaches

that the corrosion resistance is superior to that of aluminum oxide ... and intermediate layers for other coating materials.”

The Official Action further asserts that Bamberg discloses the coating of metal parts exposed to high temperature and gases with cerium oxide containing coatings. The Official Action asserts that plasma chambers and other parts used in semiconductor manufacturing are frequently made of aluminum or aluminum oxide and may also have an anodized coating for corrosion resistance. The Official Action alleges that it would have been obvious to have a cerium oxide coating on the inside of the chamber or other process chamber parts for better corrosion resistance.

Applicants respectfully disagree with the above assertions and submit that the subject matter recited in Claims 11, 14-19, 24-35, 37, 39, 40, 43, 45 and 46 is patentable over the cited combination of references for the following reasons.

A. The ground of rejection relies on non-analogous prior art

A reference cannot be relied on under 35 U.S.C. § 103 unless the reference is “analogous” prior art with respect to the claimed subject matter. As stated in MPEP § 2141.01(a):

The examiner must determine what is ‘analogous prior art’ for the purpose of analyzing the obviousness of the subject matter at issue. ‘In order to rely on a reference as a basis for rejection of an applicant’s invention, the reference must either be in the field of applicant’s endeavor or, if not, then be reasonably pertinent to the particular problem with which the invention was concerned’ (citations omitted).

As stated in In re Wood and Eversole, 202 USPQ 171, 174 (CCPA 1979), “[t]he rationale behind this rule precluding rejections based on combination of

teachings of references from nonanalogous arts is the realization that an inventor could not possibly be aware of every teaching in every art."

The present claims are directed to a component of semiconductor processing equipment. Semiconductor processing equipment includes components that are exposed to plasma during semiconductor processing, such as during plasma etching processes. Plasma environments are highly corrosive and/or erosive to materials that have previously been utilized to form such components. The resulting corrosion and/or erosion can cause materials exposed to the plasma to wear and thereby create a source of particle and heavy metal contamination in semiconductor processing equipment.

The claimed component of semiconductor processing equipment is directed to the problem of providing a surface that can protect against physical and chemical attack on such components. As explained at paragraph [0023] of the present specification, the cerium oxide containing ceramics provide erosion resistance that can reduce particle contamination in a plasma reactor chamber. The cerium oxide containing ceramics also provide resistance to both physical attack (e.g., ion sputter-induced erosion) and chemical attack by plasma. As explained at paragraph [0036] of the present specification, the cerium oxide containing ceramics provide resistance to chemical sputter-etching in plasma environments. As explained at paragraph [0054] of the present specification, the cerium oxide containing ceramics provide resistance to high sputter ion energies.

For example, Claim 1 recites "a component of semiconductor processing equipment, the component comprising an aluminum substrate and a plasma sprayed ceramic layer of cerium oxide containing ceramic material on the substrate and

forming an outermost surface of the component.” In some embodiment, the component can be a bulk part. For example, Claim 17 recites “a component of semiconductor processing equipment, the component being a bulk part consisting essentially of cerium oxide.”

For reasons stated below, Rungta and Bamberg both are not (i) in the field of semiconductor processing equipment or (ii) reasonably pertinent to the particular problem of providing a corrosion and wear-resistant surface on a component of semiconductor processing equipment. Thus, both Rungta and Bamberg are non-analogous prior art to the presently claimed subject matter for the following reasons.

B. Claim 11

Claim 11 recites a component of semiconductor processing equipment, which comprises “an aluminum substrate and a plasma sprayed ceramic layer of cerium oxide containing ceramic material on the substrate and forming an outermost surface of the component, wherein the cerium oxide containing ceramic material (a) consists essentially of one or more cerium oxides or (b) consists essentially of one or more cerium oxides as the single largest constituent thereof and an oxide of an element of the lanthanide series” (emphasis added).

Itou discloses an anticorrosive material for semiconductor fabrication, and that “a part of a product to be exposed to a fluoric corrosive gas ... or its plasma is made from a compd. thin film or single crystal. The product is e.g. a Si wafer clamp ring, upper electrode shield ring, or inner wall of a plasma treating apparatus, etching apparatus, etc., for the semiconductor fabrication. The compd. is an oxide, nitride, carbide or fluoride of 3a elements of the periodic table, e.g. Sc, La, Ce, Eu and Dy”

(emphasis added). In other words, Itou discloses products that include “a part” (i.e., a “portion” of such product) that is exposed to a corrosive gas or its plasma. Itou discloses that the “part” of the product can be made from a compound thin film or single crystal but, in stark contrast, does not suggest that the entire product can be made from the compound thin film or single crystal.

Also, the Itou Abstract is silent regarding the method of forming the compound thin film or single crystal. Itou does, however, disclose the formation of CeO_2 by PVD (physical vapor deposition) in Examples 22 and 23 at page 4. Itou does not disclose any example of forming a CeO_2 layer by plasma spraying, much less forming a CeO_2 layer on an aluminum substrate by plasma spraying.

1. Rungta is non-analogous prior art

Rungta discloses methods of applying a coating on aluminum alloys. Rungta discloses that the coated aluminum alloys are particularly suited for use in automobiles (column 4, lines 26-34). However, Rungta does not suggest that the aluminum alloys are suitable for use in a component of semiconductor processing equipment. Accordingly, Rungta is not directed to the same field of endeavor as the subject matter recited in Claim 11.

Moreover, according to Rungta, the disclosed coating process for aluminum alloys is directed to the specific problem of providing barrier layers on aluminum alloys while avoiding the use of toxic, polluting and hazardous compounds, such as chromium and hydrogen peroxide (column 2, lines 10-21). Accordingly, Rungta also is not reasonably pertinent to the particular problem of providing a corrosion and

wear-resistant surface on a component of semiconductor processing equipment, as is the subject matter recited in Claim 11.

Thus, Rungta does not qualify as analogous prior art with respect to the subject matter recited in Claim 11. Therefore, the ground of rejection of Claim 11 advanced in the Official Action is improper.

2. Bamberg is non-analogous prior art

Bamberg discloses heat insulation layers on metal structural parts and processes for applying such heat insulation layers on aluminum alloys. Bamberg discloses that the heat insulation layer is preferably used as a protective layer for drive components in a hot-gas channel, preferably for the coating of turbine blades and annular shroud segments (column 2, lines 26-31). Bamberg discloses that another preferred application of the heat insulation layer is to protect engine components, such as pistons or valves (column 2, lines). However, Bamberg does not suggest that the heat insulation layer is suitable for use in semiconductor processing equipment. Accordingly, Bamberg is not directed to the same field of endeavor as the subject matter recited in Claim 11.

Moreover, Bamberg is not reasonably pertinent to the particular problem of providing a corrosion and wear-resistant surface on a component of semiconductor processing equipment, as is the subject matter recited in Claim 11. In contrast, Bamberg is specifically directed to the problem of providing a protective layer on the preferred turbine blades, annular shroud segments and engine components, which are not used in semiconductor processing equipment.

Thus, Bamberg does not qualify as analogous prior art with respect to the subject matter recited in Claim 11. Therefore, the ground of rejection of Claim 11 advanced in the Official Action is improper for this additional reason.

In further support of the un-obviousness of the claimed component of semiconductor processing equipment, Applicants have attached a copy of a decision rendered by the U.S. Patent Office Board of Patent Appeals and Interferences. In the appeal, the Board considered the issue of the patentability of a similar component of semiconductor processing equipment that included a fullerene containing material forming a plasma exposed surface. A reference, "Fagan," was applied as a secondary reference against the claims in different grounds of rejection under 35 U.S.C. § 103. In contrast to the claimed subject matter, Fagan did not disclose or suggest a component of semiconductor processing equipment including a fullerene containing material. The Board reversed the rejections under 35 U.S.C. § 103, reasoning as follows:

The Examiner has not provided adequate reasons why there is motivation to combine the references and why such a combination would have rendered the claimed subject matter unpatentable under 35 U.S.C. § 103(a). ... Fagan does not disclose that the fullerene containing material could be applied to surfaces of components commonly used in semiconductor processing equipment. Further, Fagan does not disclose that fullerene containing materials are resistant to plasma from a semiconductor reactor. The mere fact that the prior art could be modified as proposed by the Examiner is not sufficient to establish a *prima facie* case of obviousness. The Examiner has failed to cite evidence in the prior art that the suggestion to modify the cited references as proposed by the Examiner exists. (Decision at paragraph bridging pages 4-5).

Consistent with the Board's Decision, because Rungta and Bamberg fail to disclose that the mixed barrier layer and heat insulation layer, respectively, could be applied to a component of semiconductor processing equipment, much less provide

corrosion and wear resistance to a plasma environment in such equipment, the Official Action has not established a *prima facie* case of obviousness regarding the component of semiconductor processing equipment, as recited in Claim 11.

3. Rungta and Bamberg fail to cure the deficiencies of Itou

Furthermore, Rungta and Bamberg fail to cure the deficiencies of Itou regarding the claimed subject matter for additional reasons. Particularly, Rungta discloses methods that comprise incorporating a cerium oxide material into an aluminum oxide film by a wet chemical process. The aluminum oxide film is formed by using a hygroscopic composition, such as triethanolamine, to form a bohmite film ($\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$) on aluminum (column 2, lines 63-66). Then, a rare earth oxide coating is developed by treating the metal surface with an aqueous solution of a rare earth chloride (column 2, line 66 – column 3, line 2). The coating formed on the metal structural part by the chemical reaction process is a mixed barrier layer containing both aluminum oxide in a substantial amount and the cerium oxide incorporated in the aluminum oxide (column 3, lines 2-5). Clearly, the cerium oxide is not the single largest constituent of the mixed layer.

Rungta fails to suggest forming a plasma sprayed ceramic layer of cerium oxide containing ceramic material on an aluminum substrate, where the ceramic layer forms an outermost layer of the component, and "the cerium oxide containing ceramic material (a) consists essentially of one or more cerium oxides or (b) consists essentially of one or more cerium oxides as the single largest constituent thereof and an oxide of an element of the lanthanide series" (emphasis added). Accordingly,

Rungta does not suggest modifying Itou's product to result in the combination of features, as recited in Claim 11.

Bamberg discloses that it is known to provide a lining or layer of ceramic material on a metal structural part by means of plasma spraying or vaporization. However, Bamberg states that such ceramic layers have unsuitable structures and can ultimately completely break down due to cracking (column 1, lines 19-33). Bamberg further states that such structures cannot effectively protect the structural part against oxidation (column 1, lines 34-36). Bamberg does not suggest providing a plasma sprayed ceramic layer or a ceramic layer formed by vaporization on a component of semiconductor processing equipment.

However, as explained at MPEP § 2141.03, page 2100-122 (Feb. 2003), "[a] prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)". The Official Action has failed to consider Bamberg as a whole, including those portions of Bamberg that would have led one having ordinary skill in the art away from providing a plasma sprayed ceramic layer or a ceramic layer formed by vaporization on a metal part.

Bamberg discloses a method of forming a ceramic heat insulation layer on a metal structural part. In a preferred embodiment, a passivating ceramic material (stabilized zirconium oxide or cerium oxide) is impregnated into microcracks in a heat insulation layer (column 1, line 62 - column 2, line 8). Bamberg discloses that the heat insulation layer can be formed by plasma spraying (see Examples 1-3 at columns 3-4) or PVD (Example 4 at column 4). Bamberg requires that a passivating

material, such as cerium oxide, be impregnated into cracks of the heat insulation layer. The resulting heat insulation layer is a mixed barrier layer containing both the heat insulation layer material (e.g., zirconium dioxide; see column 2, lines 38-39) and cerium oxide. Bamberg does not suggest that the heat insulation layer may consist essentially of cerium oxide, or that cerium oxide may be the single largest constituent of the heat insulation layer.

As stated in MPEP § 2143.01, page 2100-126 (Feb. 2003), "[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ 1430 (Fed. Cir. 1990)". However, Rungta and Bamberg fail to provide the requisite motivation to modify Itou's product to include a plasma sprayed ceramic layer of cerium oxide containing ceramic material on an aluminum substrate, where the ceramic layer forms an outermost layer of the component, and where "the cerium oxide containing ceramic material (a) consists essentially of one or more cerium oxides" or "(b) consists essentially of one or more cerium oxides as the single largest constituent thereof and an oxide of an element of the lanthanide series" (emphasis added), as recited in Claim 11.

Accordingly, the Official Action has not established a case of *prima facie* obviousness regarding the component recited in Claim 11.

Dependent Claims 14-16, 19, 24, 37, 39 and 40 also are patentable over the cited combination of references for at least the same reasons that Claim 11 is patentable. Moreover, these dependent claims recite additional features that further patentably distinguish the claimed subject matter over the cited references. For example, Claim 14 recites that "the aluminum substrate has an anodized surface and

the ceramic layer is disposed on the anodized surface.” In contrast, Rungta discloses incorporating cerium oxide into, not on, an aluminum oxide film, and thus does not suggest the features recited in Claim 14.

Claim 40 recites the features of the component “including a first intermediate layer, the ceramic layer being (i) on the first intermediate layer or (ii) on an optional second intermediate layer disposed on the first intermediate layer, the first intermediate layer and the optional second intermediate layer being of the same or a different material selected from the group consisting of refractory metals, Al_2O_3 , SiC , Si_3N_4 , boron carbide, AlN , TiO_2 , and polymers.” As explained above, the recited first and/or second intermediate layers are necessarily between the substrate and the ceramic layer.

The Official Action asserts that Rungta discloses “intermediate layers for other coating materials (Col 4 lines 34-37)”. However, Rungta discloses that “[i]n addition, further corrosion protection can be readily attained by painting the barrier layer, which provides a highly adherent surface for other coating materials.” That is, Rungta discloses that the paint layer and other coating materials can be provided over, not under, the barrier layer of aluminum oxide and rare earth oxide. Thus, Rungta clearly does not suggest the combination of features recited in Claim 40.

C. Claim 17

Claim 17, as amended, recites a component of semiconductor processing equipment, wherein “the component being a bulk part consisting essentially of cerium oxide, the component being selected from the group consisting of a plasma chamber wall, a chamber liner, a gas distribution plate, a gas ring, a pedestal, a

dielectric window, an electrostatic chuck, and a focus ring, and the cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof" (emphasis added). The cited references fail to suggest the component recited in Claim 17.

Itou fails to disclose or suggest a bulk part consisting essentially of a cerium oxide containing ceramic material, as recited in Claim 17. Itou discloses that a part of a product, not the entire product, can be made from a thin film or single crystal.

Moreover, for the reasons stated above, Rungta and Bamberg are both non-analogous prior art with respect to the component of semiconductor processing equipment, as recited in Claim 17. Also, in light of the attached Board Decision, the Official Action has not established a *prima facie* case of obviousness regarding the component of semiconductor processing equipment, as recited in Claim 17.

Furthermore, like Itou, Rungta and Bamberg are directed to forming coating layers over substrates, not to forming bulk parts consisting essentially of some material. For example, Rungta discloses forming a mixed aluminum oxide/rare earth oxide coating on a metal substrate. Neither Rungta nor Bamberg suggests forming a bulk part consisting essentially of cerium oxide, as recited in Claim 17, much less a component of semiconductor processing equipment. Thus, the cited combination of references fails to provide the requisite motivation to modify Itou to achieve the component of semiconductor processing equipment recited in Claim 17.

However, according to MPEP § 2143, page 2100-124 (Feb. 2003):

[T]he prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure" (emphasis added, citations omitted).

Moreover, according to MPEP § 2143, page 2100-124 (Feb. 2003), in order to establish a *prima facie* case of obviousness, “the prior art reference (or references when combined) must teach or suggest all the claim limitations.” However, even if the teachings of Itou, Rungta and Bamberg were combined in the manner advanced in the Official Action despite the lack of motivation for the combination, the combination of references still does not teach or suggest all of the features recited in Claim 17. Therefore, the component recited in Claim 17 also is patentable over the cited combination of references for this additional reason.

Dependent Claims 25 and 26 also are patentable over the cited combination of references for at least the same reasons that Claim 17 is patentable.

D. Claim 18

Claim 18, as amended, recites a component of semiconductor processing equipment, wherein “the component having a cerium oxide containing ceramic material forming an outermost surface of the component, the component being selected from the group consisting of a plasma chamber wall, a chamber liner, a gas distribution plate, a gas ring, a pedestal, a dielectric window, an electrostatic chuck, and a focus ring, and the cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof, wherein (a) the component is a bulk part consisting essentially of the cerium oxide containing ceramic material or (b) the cerium oxide containing ceramic material is a ceramic layer on a ceramic substrate” (emphasis added).

For the reasons stated above, Rungta and Bamberg are both non-analogous prior art with respect to the component of semiconductor processing equipment, as

recited in Claim 18. Also, in light of the attached Board Decision, the Official Action has not established a *prima facie* case of obviousness regarding the component of semiconductor processing equipment recited in Claim 18.

Furthermore, with regard to clause (a) of Claim 18, the combination of Itou, Rungta and Bamberg fails to suggest a component of semiconductor processing equipment, comprising "a cerium oxide containing ceramic material forming an outermost surface of the component," where "the component is a bulk part consisting essentially of the cerium oxide containing ceramic material" (emphasis added).

Claim 33 depends from Claim 18 and requires that "the component is the bulk part."

With regard to clause (b) of Claim 18, the combination of Itou, Rungta and Bamberg fails to suggest a component of semiconductor processing equipment, which comprises "a cerium oxide containing ceramic material forming an outermost surface of the component, ... and the cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof, wherein ... (b) the cerium oxide containing ceramic material is a ceramic layer on a ceramic substrate" (emphasis added). Itou does not disclose forming a "cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof," where "the cerium oxide containing ceramic material is a ceramic layer on a ceramic substrate" (emphasis added), as claimed.

Neither Rungta nor Bamberg suggests a "cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof," as recited in Claim 18. Accordingly, the combination of features recited in Claim 18 also is patentable over the cited references.

Claims 27-35 and 43, 45 and 46 depend from Claim 18 and, accordingly, also are patentable for at least the same reasons that Claim 18 is patentable. Moreover, these dependent claims recite additional combinations of features that further patentably distinguish the claimed component over the cited combination of references. For example, Claim 27, as amended, recites the features of "the cerium oxide containing ceramic material comprises a plasma sprayed ceramic layer directly on a plasma sprayed intermediate layer formed on the substrate." As explained above, the cited references fail to suggest forming the recited plasma sprayed ceramic layer, much less "directly on a plasma sprayed intermediate layer formed on the substrate," as recited in Claim 27.

Claim 28, as amended, recites the features that the component "comprises a preformed chamber liner consisting essentially of the cerium oxide containing ceramic material." Claim 29, as amended, recites the features of "the chamber liner is adapted to be attached to or interlock with another component of the semiconductor processing equipment. Support for Claims 28 and 29 is provided in paragraph [0051] of the present specification. The cited combination of references fails to suggest the combination of features recited in Claims 28 and 29.

Therefore, withdrawal of the rejection is respectfully requested.

Second Rejection Under 35 U.S.C. §103

Claims 11, 14, 16-19, 24-29, 31-35, 37, 39, 42, 43, 45 and 48 were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,447,636 to Qian et al. ("Qian") in view of U.S. Patent No. 6,123,791 to Han et al. ("Han"). The reasons for the

rejection are stated on page 4 of the Office Action. The rejection is respectfully traversed.

A. Claim 11

As discussed above, Claim 11 recites a component of semiconductor processing equipment, which comprises "an aluminum substrate and a plasma sprayed ceramic layer of cerium oxide containing ceramic material on the substrate and forming an outermost surface of the component, wherein the cerium oxide containing ceramic material (a) consists essentially of one or more cerium oxides or (b) consists essentially of one or more cerium oxides as the single largest constituent thereof and an oxide of an element of the lanthanide series" (emphasis added). In other words, Claim 11 is directed to a component that includes a substrate and an overlying plasma sprayed ceramic layer of cerium oxide containing ceramic material.

The Official Action asserts that "Qian et al disclose parts of a plasma process chamber for semiconductor manufacturing made of aluminum or ceramic like aluminum oxide combined with an oxide of Group IIIB metal like cerium." The Official Action admits that Qian does not disclose the relative proportions of aluminum oxide to Group III element oxide, and that Qian does "not disclose that the parts could be bulk parts."

The Official Action further asserts that Han discloses "a process kit for semiconductor manufacturing ... having a composition of aluminum oxide ceramic and Group III oxide and disclose that the proportion could be 70%" Applicants respectfully submit that Qian and Han fail to suggest the combinations of features recited in Claims 11-19.

Qian discloses a plasma reactor including a dome or top 103, which can be made entirely of quartz or ceramic, or mostly from ceramic with a dome insert 200 typically made of quartz (paragraph bridging columns 5-6). Accordingly, the embodiment of the dome made entirely of quartz or ceramic is, in fact, a bulk part. In such embodiments, and also in embodiments that include a dome insert of a dielectric material, the entire dome is made of a dielectric material.

In contrast to the component recited in Claim 11, Qian does not suggest that the top 103 could include an aluminum substrate, as recited in Claim 11. Qian discloses that the top is typically electrically insulating and is made entirely of a dielectric material. Accordingly, Qian clearly teaches away from modifying the all-dielectric material, electrically insulative top 103 to include an aluminum substrate, i.e., a non-dielectric material, as recited in Claim 11.

Han fails to cure the deficiencies of Qian regarding the component recited in Claim 11. Han discloses ceramic compositions for a process kit and a dielectric window of a reactor chamber. Han discloses that the compositions include a ceramic compound and an oxide of a Group IIIB metal, but does not suggest that the ceramic compound is a ceramic layer on a substrate. Han fails to provide any motivation to modify the bulk top 103 disclosed in Qian to produce a component comprising any material other than a dielectric material, much less a component comprising an aluminum substrate and a ceramic layer of cerium oxide containing ceramic material on the aluminum substrate, which Qian clearly teaches away from.

Also, Han discloses bulk parts of ceramic compositions and does not suggest forming a cerium oxide containing ceramic material on an aluminum substrate. Accordingly, even if the teachings of Qian and Han were combined despite there

being no motivation to do so, the combined teachings still would not result in the combination of features recited in clause (a) of Claim 11, which includes a ceramic layer of a cerium oxide containing ceramic material that “consists essentially of one or more cerium oxides.”

The cited references also do not suggest a component comprising a ceramic oxide containing ceramic material on a substrate as recited in clause (b) of Claim 11, wherein the ceramic material consists essentially of one or more cerium oxides as the single largest constituent thereof and an oxide of an element of the lanthanide series” (emphasis added). Accordingly, the component recited in Claim 11 is patentable over the combination of Han and Qian. Dependent Claim 37 recites the features of “the cerium oxide containing ceramic material consists essentially of (i) one or more cerium oxides as the single largest constituent thereof and (ii) an oxide of an element of the lanthanide series,” and thus also is patentable.

Dependent Claims 14-16, 19, 24, 37 and 39 also are patentable over the cited combination of references for at least the same reasons that Claim 11 is patentable. Moreover, these dependent claims recite additional combinations of features that further patentably distinguish the claimed component over the cited combination of references. For example, Claim 14 recites the features of “the aluminum substrate has an anodized surface and the ceramic layer is disposed on the anodized surface” (emphasis added). Claim 15 recites the features of “the ceramic layer has a thickness in a range from about 0.001 to 0.050 inches.” In contrast, Qian and Han fail to suggest any ceramic layer, much less a ceramic layer having the claimed thickness.

B. Claim 17

Claim 17, as amended, recites a component of semiconductor processing equipment, wherein "the component being a bulk part consisting essentially of cerium oxide, the component being selected from the group consisting of a plasma chamber wall, a chamber liner, a gas distribution plate, a gas ring, a pedestal, a dielectric window, an electrostatic chuck, and a focus ring, and the cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof" (emphasis added).

As explained in MPEP § 211.03 (Feb. 2003), "[t]he transitional phrase 'consisting essentially of' limits the scope of a claim to the specified materials or steps 'and those that do not materially affect the basic and novel characteristic(s) of the claimed invention" (citations omitted). Qian and Han fail to disclose or suggest "a component of semiconductor processing equipment, the component being a bulk part consisting essentially of cerium oxide " (emphasis added).

Namely, Qian discloses that dome 103 is made of a ceramic compound that may combine with an oxide of a Group IIIB metal. Although the large group of Group IIIB metals disclosed by Qian includes cerium, Qian does not suggest making the dome 103 of a ceramic composition that consists essentially of cerium oxide.

As admitted in the Official Action, Han discloses that the ceramic compound and the oxide of the Group IIIB metal may combine in ratios of up to about 70% by weight of the Group IIIB metal oxide and 30% by weight of the ceramic compound (column 2, lines 47-55). Han further discloses that "more preferably, the ceramic composition comprises a major proportion of the ceramic compound and a minor proportion of the oxide of a Group IIIB metal." The finished dielectric member also

includes as much as 15% of a combination of additive agent and binder (column 8, lines 30-38). Han does not suggest that the ceramic compound present in a minimum amount of 30% by weight of the dielectric member, or more preferably in a major proportion, and additionally up to 15% of a combination of additive agent and binder, does not affect the basic and novel characteristics of the dielectric member. Accordingly, Han fails to disclose or suggest "a component of semiconductor processing equipment, the component being a bulk part consisting essentially of cerium oxide" (emphasis added). Thus, the combination of Qian and Han does not suggest the combination of features recited in Claim 17, which therefore is patentable.

Dependent Claims 25, 26 and 42 are also patentable for at least the same reasons that Claim 17 is patentable.

C. Claim 18

Claim 18, as amended, recites a component of semiconductor processing equipment, wherein "the component having a cerium oxide containing ceramic material forming an outermost surface of the component, the component being selected from the group consisting of a plasma chamber wall, a chamber liner, a gas distribution plate, a gas ring, a pedestal, a dielectric window, an electrostatic chuck, and a focus ring, and the cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof, wherein (a) the component is a bulk part consisting essentially of the cerium oxide containing ceramic material or (b) the cerium oxide containing ceramic material is a ceramic layer on a ceramic substrate" (emphasis added).

For reasons stated above, Qian and Han fail to disclose or suggest "a component of semiconductor processing equipment, the component having a cerium oxide containing ceramic material forming an outermost surface of the component, ... the cerium oxide containing ceramic material comprising one or more cerium oxides as the single largest constituent thereof, wherein (a) the component is a bulk part consisting essentially of the cerium oxide containing ceramic material or (b) the cerium oxide containing ceramic material is a ceramic layer on a ceramic substrate" (emphasis added). Accordingly, Claim 18 also is patentable over Qian and Han.

Dependent Claims 27-29, 31-35, 43, 45 and 48 are also patentable for at least the same reasons that Claim 18 is patentable.

Therefore, withdrawal of the rejection is respectfully requested.

Third Rejection Under 35 U.S.C. §103

Claims 38, 41, 44 and 47 were rejected under 35 U.S.C. §103(a) over Itou in view of Rungta and Bamberg and further in view of U.S. Patent No. 6,096,381 to Xiaoci Maggie Zheng ("Zheng"). The reasons for the rejection are stated on pages 4-5 of the Office Action. The rejection is respectfully traversed.

The Official Action admits that Rungta "does not disclose rough surface in order to have good adhesion." However, the Official Action asserts that Zheng discloses plasma spray ceramic coating for thermal barrier in a harsh thermal environment and that adhesion mechanism is by mechanical interlocking to a rough surface, and that it would have been obvious to have an underlying rough surface for good adhesion of a ceramic coating. Applicants respectfully disagree.

Zheng discloses components, such as gas turbine engines components, that include a substrate 12 of an iron, nickel or cobalt-base superalloy or other high-temperature material, a bond coat 16 on the substrate 12, and a ceramic layer 18 on the bond coat 16 (column 4, lines 26-34 and FIG. 1). The ceramic layer 18 is preferably of yttria-stabilized zirconia, but may be stabilized by other materials, such as magnesia, ceria, scandia and alumina (column 4, lines 38-43).

Zheng is not analogous prior art with respect to the subject matter recited in Claims 38, 41, 44 and 47. Particularly, Zheng is not (i) in the field of semiconductor processing equipment or (ii) reasonably pertinent to the particular problem of providing a corrosion and wear-resistant surface on a component of semiconductor processing equipment. Accordingly, the ground of rejection is improper for at least this reason.

Furthermore, Zheng fails to cure the deficiencies of Itou, Rungta and Bamberg regarding the subject matter recited in independent Claims 11 and 18. Claims 38 and 41 depend from Claim 11, and Claims 44 and 47 depend from Claim 18. Zheng fails to suggest modifying Itou to result in a component of semiconductor processing equipment as recited in Claim , wherein the component comprises “an aluminum substrate and a plasma sprayed ceramic layer of cerium oxide containing ceramic material on the substrate and forming an outermost surface of the component, wherein the cerium oxide containing ceramic material (a) consists essentially of one or more cerium oxides or (b) consists essentially of one or more cerium oxides as the single largest constituent thereof and an oxide of an element of the lanthanide series” (emphasis added). Accordingly, the component recited in dependent Claims 38 and 41 also is patentable.

Moreover, Zheng fails to cure the above-described deficiencies of Itou, Rungta and Bamberg regarding the combination of features recited in Claim 18. Accordingly, the component recited in dependent Claims 44 and 47 also is patentable.

Therefore, withdrawal of the rejection is respectfully requested.

Conclusion

For the foregoing reasons, allowance of the application is respectfully requested. Should there be a need to discuss any issue relating to the application, the undersigned attorney can be reached at the telephone number given below.

Respectfully submitted,

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